



CENTERS OF DATA

OPPORTUNITIES FOR ARTIFICIAL INTELLIGENCE IN THE DATA CENTER

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INTRO

Artificial Intelligence is more than 'the next big thing.' The potential for computers to outsmart humans is hardwired into our culture and consciousness, and all the indications are that we are living in the final days of our intellectual supremacy.

Estimated in terms of computations per second per \$1,000, computers overtook the mouse brain in 2015, putting them at about a thousandth of the human level. This doesn't sound like much until you remember that we were at around a trillionth in 1985. The current trajectory will see Artificial Intelligence overtake the human brain affordably by 2025. While the learning and improvement mechanisms necessary to make that intelligence general rather than specific still require work - most current forecasts for superior general artificial intelligence come around a decade later, around 2035. At this point the speed of AI improvement will be such that computers will whizz past us, making us almost infinitely 'stupider' in a matter of months.

The major existential issues raised by this critical event in human history will not be addressed in this paper. Instead, it will focus on what is commercially achievable with AI as it stands today:

- + What are the currently available AI technologies and what commercial impact are they having?
- + What are the potential benefits of these technologies to businesses based in cloud-connected data centers?
- + Are these benefits significant enough to justify a shift to AI-driven applications?
- + If they are, what needs to be done by way of preparation and planning?

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ARTIFICIAL INTELLIGENCE AN ELUSIVE TERM

The current Wikipedia definition of Artificial Intelligence (AI) is "intelligence exhibited by machines, rather than humans or other animals... Colloquially, the term "artificial intelligence" is applied when a machine mimics "cognitive" functions that humans associate with other human minds, such as "learning" and "problem solving".

John McCarthy, who coined the term "Artificial Intelligence" in 1956, complained that; "As soon as it works, no one calls it AI anymore."

The Wikipedia definition goes on to explain why a set definition of AI is hard to pin down: "The scope of AI is disputed: as machines become increasingly capable, tasks considered as requiring "intelligence" are often removed from the definition, a phenomenon known as the AI effect, leading to the quip "AI is whatever hasn't been done yet." For instance, optical character recognition is frequently excluded from "artificial intelligence", having become a routine technology. Capabilities generally classified as AI, as of 2017, include successfully understanding human speech, competing at a high level in strategic game systems (such as chess and Go), autonomous cars, intelligent routing in content delivery networks, military simulations, and interpreting complex data."

REALITY CHECK: THE AI LANDSCAPE

AI is so tied to science fiction in our perception that media coverage of the level and variety of implementations is heavily distorted.

This distortion is most obvious in areas in which computers (or robots) replace humans. In 2013 an Oxford University study predicted that 47% of jobs could be automated by 2033. A 2016 report by the Organization for Economic Cooperation and Development (OECD) said that 9% of jobs in the OECD 21 country zone could be done by computers.

These studies received widespread coverage and generated a broad debate. However, in the near-term there appears to be less impact on jobs. In January 2017, McKinsey's research arm estimated AI-driven replacement of entire jobs at 5%. Tata Consultancy Services also released a survey in 2017 that predicts a net job loss of between 4% and 7% in key business functions by the year 2020 due to AI.

Despite the hype, AI implementation is currently limited. A Forrester report on Artificial Intelligence and the Enterprise found that only 12% of the 391 business and technology professionals it polled are currently using A.I. systems. However, 58% are researching A.I. technologies and what it takes to support their use in the enterprise, and 39% are identifying and designing A.I. capacities to deploy.

How companies around the world are using AI



Source: Tata Consultancy Services Survey of 835 Companies 2017

The research by Tata Consultancy Services shows that, among larger companies, high profile AI applications like automated high-frequency trading and recommendation systems are actually less frequently used than 'back-end' solutions such as compliance monitoring, IT support and security.

MARKET POTENTIAL

While current uptake is limited, the potential of AI to accelerate and transform businesses of all sizes is breathtaking:

- + Tractica forecasts that the revenue from enterprise AI applications will increase from \$1.4 billion in 2016 to \$59.8 billion by 2025 (see top 10 applications by revenue on the right graph)
- + A PwC survey of 2,500 US business and consumer leaders showed that 72% of them believe A.I. will be the biggest business advantage of the future
- + Accenture goes even further. Their analysis of 12 developed economies (which together account for over 50 percent of the world's economic output) found that AI has the potential to double their annual economic growth rates by 2035.

Cumulative AI Software Revenue, Top 10 Use Cases,
World Markets: 2016 - 2025

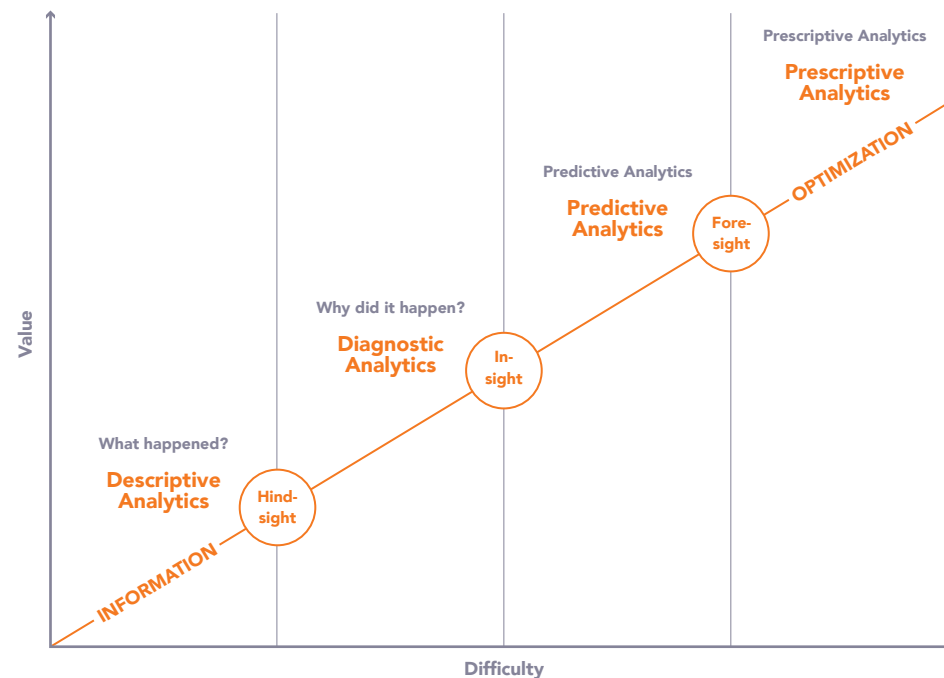


OIL NOT GOLD

All AI-related applications are data analytics-based. The key factors enabling AI growth are unlimited access to computing power, particularly through the public cloud, and the growth in big data. According to Barry Smyth, Professor of Computer Science at University College Dublin, "Data is to AI what food is to humans." Global data has seen a compound annual growth rate (CAGR) of more than 50 percent since 2010 as more of the devices around us have become connected.

'Oil not gold' is a useful, if not very environmentally friendly, metaphor when relating AI strategy to your business goals. It is borrowed from IBM's Mac Devine, who stated that data used to be like gold—only for the privileged few, and hidden away in safe places. With the advent of AI, that data needs to be treated more like oil, where its value comes from its use, and it can be leveraged to solve problems every day. With one key difference from oil; that data is reusable and the more it is used (and the more sophisticated the analytics) the more valuable it becomes.

Analytic Value Escalator



Source: Tata Consultancy Services Survey of 835 Companies 2017

With total data levels set to expand to 44 zettabytes by 2020, the problem for machine learning systems is no longer a lack of information, it's the potential for fragmentation. As for all analytics, data needs to be rearranged for AI access and autonomous use of data by AI functions. Therefore, the first focus for a business looking at leveraging AI must be building robust data management systems and creating structured data sets that can yield the kinds of insights and information needed for A.I. technologies to produce results. Disparate and legacy systems and stacks and disconnected tools starve AI. Companies need their technology vendors to provide open APIs and connected hub solutions in order ensure that valuable data does not get locked inside inaccessible tools.

"DATA IS TO AI
WHAT FOOD IS TO
HUMANS."

CENTERS OF DATA

The vast majority of this accessible data will reside in cloud-connected data centers. According to Cisco, global cloud IP traffic will account for more than four-fifths (83 percent) of total data center traffic by 2019, marginalizing the traditional data center (17 percent). Large carrier and cloud-neutral data centers offer economies of scale and interconnection which will enable high-speed cloud data refresh frequency and the compliant treatment of sensitive data through a hybrid cloud structure.

The range of interconnection partners available in cloud-neutral data centers also has the potential to accelerate the move to AI. In a recent report, Forrester summarizes the current AI leaders as follows:

"Internet giants and digital natives such as Airbnb, Alibaba, Amazon, Apple, Facebook, Google, Netflix, Uber, and others use AI technology building blocks to build billion-dollar empires...These technology behemoths are no longer alone. Software giants (such as IBM, HP Enterprise, Microsoft, Oracle, Salesforce, and SAS), start-ups (such as Artificial Solutions), and open source projects (such as TensorFlow and Apache SystemML) offer AI tools, platforms, and/or solutions for enterprise consumption."

Proximity to these providers in a genuinely cloud-neutral facility will allow you to access intelligent applications and buy, borrow – and sell – data in this hugely exciting new marketplace.

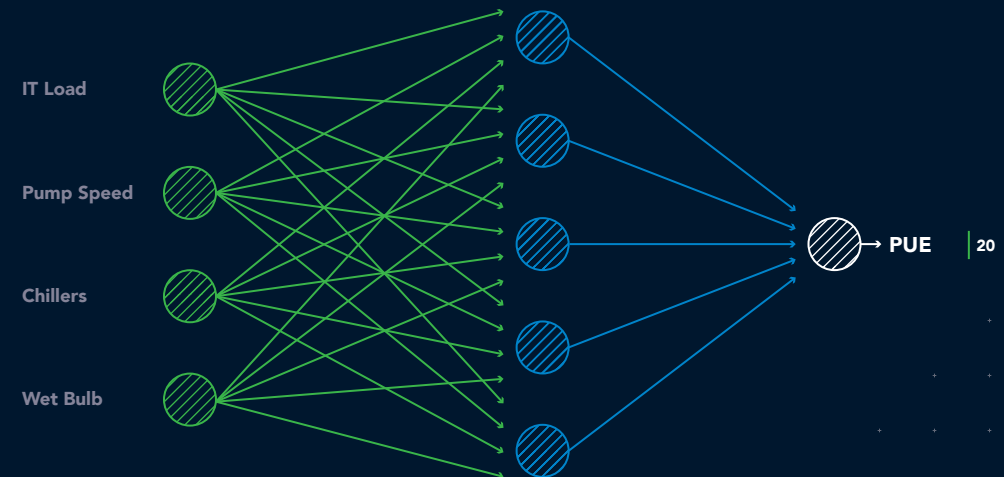
This wealth of valuable data will change the nature of the data center over time. Mac Devine of IBM talks about the "move from data centers to centers of data." Traditionally, the data center has been used as a large data repository, which users can then leverage using data science and analysis. AI enables a "cognitive loop" to be inserted in the data center, generating an increasing range of insights at the edge and in real time. The management of that data will be a critical first task for AI-related technologies: Technologies like IoT, big data, and cognitive computing will also change the management structure of the data center, prompting the need for things like autonomous management, as there are billions of data points brought about from connected devices, and it scales beyond the capability of human managers.

INTELLIGENT INFRASTRUCTURE

As well as capitalising on the data in the data center for customer applications, AI is set to significantly enhance the efficiency of the infrastructure itself. Machine Learning will be a key enabler of the move to more effective Data Center Infrastructure Management (DCIM), generating tangible efficiency benefits in the medium term.

19 | Google's recent Data Center IQ (DCIQ) project involved building a proof-of-concept 'neural-network ensemble' which simulated the components in a data center. Once this was built, the team added DQN ('Deep Q-Network'), which is a deep learning AI algorithm developed as part of their DeepMind project. When this new application was plugged into a data center, it managed a remarkable 40% reduction in energy used for cooling, which equates to a 15% reduction in overall Power Usage Effectiveness (PUE) overhead.

The DCIQ team's work could also potentially improve power plant conversion efficiency (getting more energy from the same unit of input), and reduce semiconductor manufacturing energy and water



A simplified version of what the Google DCIQ models do: gather data, find the hidden interactions, then provide recommendations that optimize for energy efficiency. DCIQ clearly has huge potential for complex infrastructure challenges, particularly as Google has stated its intention to share the technology.

CONCLUSION: READY, STEADY, THINK

While for most enterprises the current benefits of AI are peripheral rather than central to their business, over the coming few years there will be a growing range of opportunities in the cloud-connected data center. Sector-specific Machine Learning platforms will be revolutionary and CIOs should be on top of the latest developments.

The greatest areas of opportunity both reside in the cloud data center. Collaborative data sharing and processing platforms and hubs, typically deploying third party analytics, will deliver a range of smart services, and machine learning will enhance efficiency in the data center-based compute and connect infrastructure.

What should businesses focus on? According to a recent multi-country survey by the McKinsey Global Institute, the top challenges to attaining data and analytics objectives are:

- + Designing an appropriate organizational structure to support data and analytics activities (45%),
- + Ensuring senior management involvement (42%)
- + Designing effective data architecture and technology infrastructure (36%)

Infrastructure managers, CTOs, CIOs and other board members should keep their eyes, ears - and their data - open:

- + Ensure that all of data is cloud-accessible via open platforms; make data accessibility a must for new tools and platforms
- + Assess proprietary data and define its value against the AI use case spectrum
- + Agree business objectives in order to move fast on relevant third party intelligent platforms and invest in resources and development opportunities.

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